

A Network Digital Teaching Mode of Basketball Based on Ecological Learning Space

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Abstract—College basketball course is a basic course concerning students' physical quality. Traditional physical education neglects students' dominant role, and limits the development of students' subjective initiative, thus leading to the situation that students are fond of basketball activities but dislike basketball course. Thus, a network digital teaching mode based on ecological learning space was constructed on the basis of inquiry learning. Based on the development of inquiry learning and ecological learning space, college basketball course was taken for example to analyze digital resource expansion system, teaching activity design steps of learning space platform, and teaching framework system in detail. The relationship between data point number and parameter number in the model was adopted to analyze the identification features of degree of freedom which conforms to the decision model in the research model. Meanwhile, the factors influencing ecological learning space of college basketball were deeply analyzed, and the ecological learning space teaching model based on inquiry learning was constructed. The teaching effect test shows that this teaching mode is approved by students, can obviously improve students' learning interest and learning initiative, and contributes to improving students' physical quality.

Keywords—Ecological learning space; college basketball; inquiry learning

1 Introduction

In Chinese colleges, basketball is the favorite sport event of students, with a large number of participants and high popularity degree, so it becomes an important content of college physical education and also an important mode of extracurricular activities [1]. To let students, develop in an all-round way, various colleges actively carry out basketball education. But seeing from current basketball education in China, due to the influence of traditional physical education, college basketball teaching has some defects. The teaching mode lags behind, and it is difficult to meet students' increasing learning needs and their desire for knowledge [2]. Although some advanced teaching methods have been introduced in basketball teaching reform in recent years such as

video teaching and computer courseware presentation, and slightly changed the traditional teaching method to certain degree, the traditional teaching mode of teacher's classroom demonstration and explanation, and students' basketball court practice still fails to be gotten rid of. Students passively receive the teacher's guidance and arrangement, and the leading role of students is ignored. Meanwhile, the subjective initiative of students is restricted. As a result, students like basketball activity, but dislike basketball course. As internet is popularized, network teaching becomes a new teaching form which is being increasingly promoted, and is widely applied in each teaching system. A series of teaching system reform researches have been carried out for each subject. However, it is still necessary to further facilitate its application in college basketball education. How to develop network course teaching of college basketball, combine it with students' autonomous learning and establish the complete and dynamic scheme of basketball network teaching system becomes a hot research direction.

At present, the rising ecological learning space refers to a new inquiry learning mode in which theoretical knowledge and practical operation of each subject are organically combined to let students independently learn in the virtual learning space. In the ecological learning space, students can combine their actual conditions for self-control, choose independently, complete a series of personalized learning, enhance knowledge and improve their abilities. At present, the teaching mode of ecological learning space is rarely applied in PE teaching, and there is lack of some reference and empirical teaching experience.

From the perspective of teaching practice, an ecological learning space mode which conforms to the course demands was innovatively created in this study based on college basketball course. The ecological learning space was applied in practical teaching to promote theoretical knowledge and practical techniques of basketball. This mode carries important significance for cultivating students' physical quality and special quality. Besides, network resources and personalized learning space were combined in this study to establish application practice of personalized independent study in sport events and offer the reference for PE teaching mode reform.

2 State of the Art

The research on ecological learning space derived from personal learning system or personal learning space proposed by Sutherland [3]. ALT (Association for Learning Technology) later put forward the proposal of constructing the learning space with rich resources, supporting corresponding teaching methods and promoting the effect of learning methods in the teaching system [4]. Higgs [5] applied ecological learning space in ethics courses, and discussed the theoretical problem of network learning teaching method. The results show that ecological learning space is effective for learners to understand and grasp theoretical knowledge. The research of Kolb et al. [6] demonstrates that ecological learning space mode contributes to promoting learners' advanced study of body, intelligence and spirit fields. Domestic research on ecological learning space is still in the initial stage. Xuan [7] analyzed the connotation of

ecological learning space and construction necessity, discussed the functions that ecological learning space should achieve, and designed function module sketch of ecological learning space [3]. Hu et al. integrated ecological network learning space with specific subjects, and adopted the teaching mode of combining class exercise, collaborative learning, and learning evaluation for practice research. The results show that the teaching effect improves. Liu & Zheng [8] studied the practical application of ecological learning space and indicated that the problem of valuing “development” and ignoring “application” may easily appear during ecological learning space construction, and that it is necessary to pay close attention to it and adopt effective application means to give full play to the application potential of ecological learning space. Meanwhile, under the background of information era, basketball teaching is developed through network digital resources, information technology and internet platform resources are integrated to achieve the purpose of basketball teaching resource optimization. Hence, the proposed teaching mode becomes a research hotspot of basketball education. Numerous researches show that it can effectively promote basketball teaching quality, and adapt to students’ needs in the new era and reaching reform demand. Lv [9] flexibly applied digital technology in PE classroom teaching, motivated middle school students’ enthusiasm for PE learning, widened their view, further shortened the teaching process and effectively improve students’ sport skills [10]. Du also started to try digital teaching research in primary school PE according to students’ features [7]. But, the materials on college basketball education are relatively few.

In conclusion, the proportion of theoretical research and application research is large in the field of ecological learning space, while empirical research and evolution are rarely involved. There is lack of the research in ecological learning space model construction, learning management and evaluation of ecological learning space. Ecological learning space is rarely applied in classroom learning. Students cannot better carry out personalized independent learning. On this basis, the innovations of this study are as below: firstly, design ecological learning space of college basketball course, and formulate a set of teaching system to solve students’ personalized learning problems based on supporting personalized learning; secondly, combine inquiry learning theory for empirical study; thirdly, the relationship between data point number and parameter number in the model to analyze the identification feature of degree of freedom conforming to the decision model in the research model, evaluate and analyze the factors influencing students’ application of this teaching model so as to construct the application mode of ecological learning space of college basketball with personalized learning features.

3 Network Digital Teaching Mode of Basketball Based on Ecological Learning Space

3.1 Inquiry learning

Inquiry learning, also called special study and investigative study, refers to a learning method in which students carry out planning, execution and self-evaluation under the assistance of the teacher [11]. This theory stems from learning interactive theory. Interaction means people are related to each other, accompanied by ideological collision in the process [12]. In teaching, interactive behavior not just exists between students and the teacher, but also contains the interaction between students and teaching content, and among students. Through the interaction of three forms, learners can gain the feedback of learning results and the faith of the culture and society where they are located. The correlation between students and teaching contents are fundamental, and also the essence of forming educational connotation. In this process, students' cognitive schema can be reconstructed. The interaction between students and the teacher penetrates the whole teaching process, and effectively guarantees the interaction between students and the teaching contents. The deeper interaction between students and the teacher more contribute to improving the learning effect. When the interaction among students is deeper, students' learning enthusiasm and initiative can be better improved. Thus, inquiry learning aims to cultivate students' ability to discover, propose and solve problems.

To carry out the reform of ecological learning space teaching model based on inquiry learning, it is required to fully consider three-party interaction and correlation in the knowledge construction process of discovering, proposing and solving problems, and combine subject features and contents to integrate them organically. Or the characteristics and teaching content of college basketball teaching course, the interactive relationship of ecological learning space teaching model based on inquiry learning is shown in Fig.1.

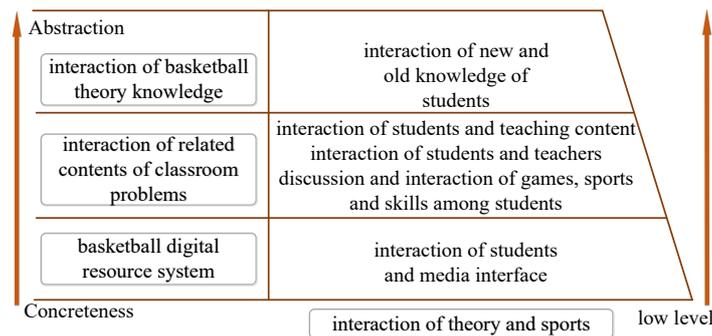


Fig. 1. Interactive relationship of college basketball course based on inquiry learning

Wherein, teaching resources can be widely collected by depending on big data platform resources, such as relevant content of “appreciation’ link of basketball skills. The teacher can collect from the digital resource expansion system of college basketball course in Fig.2 and supplement rich teaching resources.

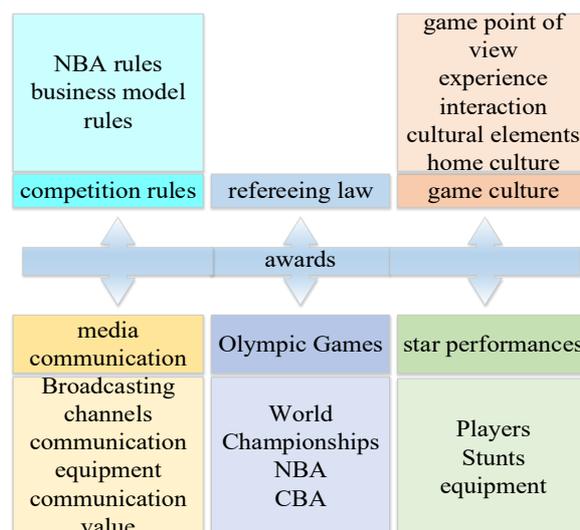


Fig. 2. Digital resource expansion system of college basketball course

3.2 Ecological learning space based on inquiry learning

As network technique and mobile equipment are applied and promoted in study and life, ubiquitous learning technology develops rapidly. People start to research and develop an intelligent classroom for extended learning with mobile devices. On this basis, network learning space is established. This improves learning means and can serve as a tool to learn theory and practice in the new situation. On this basis, a new learning mode can be created through developing ecological learning space, and fully utilizing mobile learning and intelligent classroom based on inquiry learning and interactive learning theory, and combining personal development of learning space. Therefore, in order to construct the ecological learning space teaching model based on inquiry the following three systems need to be established by combining the teaching content of college basketball course.

Construct ecological learning space mode based on inquiry learning: Combining inquiry learning theory and depending on the management of school teaching service platform for learning process, the teacher should fully excavate the resources to achieve students' autonomous learning, and depend on digital resource systems of technology, appreciation, analysis and enjoyment of college basketball involved in the network and research to form learning activities under various situations. The content of this part corresponds to the resources needed in the interaction between students

and learning contents. Besides, students' personal space can form. By depending on mobile devices such as mobile APP and teaching material APP of the school, a personalized network learning space like the classroom can be established. Students' independent study space can be established for the auxiliary function of teaching activities after class or in the extracurricular time, and the information interaction process among students and between students and the teacher can be achieved through learning management service platform of teaching system. In other words, constructing the ecological learning space platform based on the inquiry learning is the resource and means for the mode, and it is also the foundation for achieving ecological learning space teaching model based on inquiry learning. The platform should help students achieve seamless connection of "classroom learning + after-class study", and establish the virtual learning space in which students promote each other. Fig.3 shows the frame diagram of ecological learning space platform based on inquiry learning.

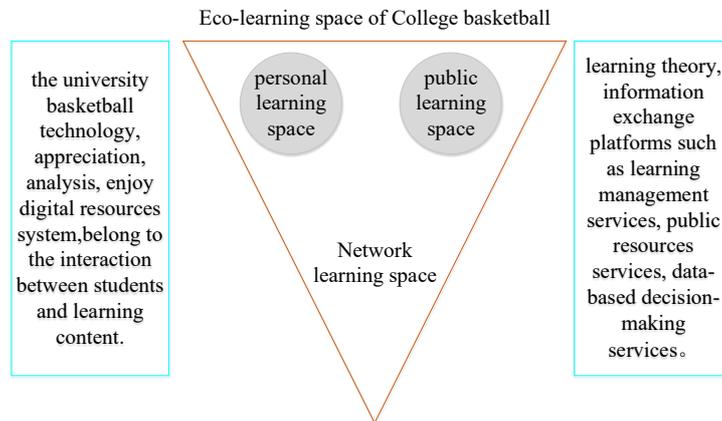


Fig. 3. Ecological learning space platform based on inquiry learning

Enhance interactive process of learning process of ecological learning space:

Enhancing the interaction between students and the teacher, among students and between students and teaching contents based on the digital teaching service platform established above is an important link for realizing inquiry learning. Thus, information technology and digital teaching service platform should be fully utilized to realize students' class and after-class learning in the ecological learning space. Besides, the interactive extended learning space which consists of "individuals - group - class" should be fully utilized to establish the interaction process of learning process. The process is shown in Table 1.

Table 1. Design steps of ecological learning space activity for college basketball course

Steps	Design content of ecological learning space
1. Specify classroom learning purpose	The teacher designs the appropriate course tasks according to the specific teaching contents
2. Analyze the specific status of students, the teacher and teaching contents	Design the specific tasks for students based on the full understanding of students' learning status. The tasks come from the new teaching contents. Guide students to discover and solve problems.
3. Analyze activity structure	Set course contents and activities, decompose classroom activities into knowledge learning behavior, basketball skills and action operation, and plan the interactive activities among students, the teacher and teaching contents.
4. Analyze tools and rules	Make the most of intelligent teaching assistance platform, confirm the supporting role of teaching platform in the activity, specify the use rules in the activity and divide the work clearly
5. Analyze the situation of classroom activity	Specify students' activity situation about the content of this chapter, and create activity situation rehearsal of student generality under the guidance of the teacher
6. Analyze activity structure in the learning process	Pay close attention to interactions of each part in the activity, and promote students' interactions and exchanges

Extend ecological learning space and carry out practical activity: To make students form learning habits, existing mobile network equipment can be fully utilized to carry out mobile study to enhance interactions among students, such as ecological learning space of “mobile study + intelligent classroom”, and to guide students to turn the spotlight to the ways of gaining knowledge from knowledge. For college basketball course, students need to apply basketball skill and dribbling motions to master them in practice. Thus, carrying out a series of competitions and rehearsal practice is an effective way to let students solve problems independently. At the same time, the concrete offline practice can be combined for exchange. To make such activities effective, students' mobile devices should be fully combined, such as establishing the WeChat group and friend circle so that students can deeply discuss and exchange to ensure learning effect. Mobile devices can be applied to provide relevant technical data of college basketball, including video and PPT, to attract students and obtain feedbacks from students. The teacher should properly provide responses to the feedbacks. In one word, it is necessary to extend classroom teaching content and further enhance students' autonomous learning ability.

3.3 Inquiry teaching mode based on STEM education

Based on the key points above, the frame of ecological learning space teaching mode frame based on inquiry learning is shown in Fig.4.

The frame of this mode is configured in detail from three systems. For example, for construction of learning platform system, the platforms required include students' effect evaluation and test platform, and teacher's teaching and research management platform are needed to implement research-based collaborative learning and research-based task management. For relevant chapters, relevant objectives should be set for theoretical knowledge classroom, and the teacher should collect relevant resources and let students learn on the learning platform. Moreover, the interaction among students, the teacher and learning contents should be enhanced, and the practical activity

of basketball should be strengthened. This mode requires network or mobile devices and the basketball court as the infrastructure.

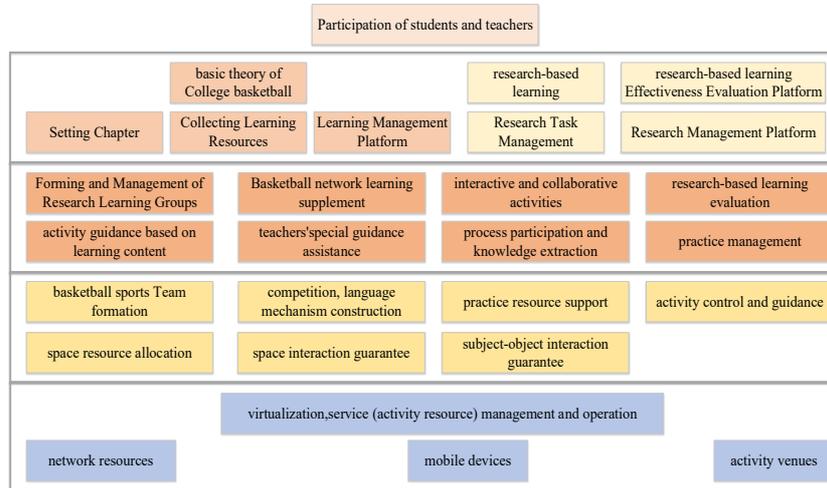


Fig. 4. Frame system chart of ecological learning space teaching mode for college basketball based on inquiry learning

3.4 Factors influencing ecological learning space teaching mode based on inquiry learning

The relationship between data point number and parameter number in the model was used to analyze the identification features of degree of freedom which conforms to the decision model in the research model. The main contents include the following:

- Computation of degrees of freedom (Default Model)
- Number of distinct sample moments: 209
- Number of distinct parameters to be estimated 69
- Degrees of freedom (209-69): 140□
- Result (Default model)
- Midmum was achieved
- Chi-square = 154.804□
- Degrees of freedom = 140
- Probablflitvr level =185

It can be seen that, the number of unique elements of the sample moment is 209; the number of parameters to be estimated is 69; the degree of freedom is 140, larger than 0, indicating that the model is excessive identification and needs improving. The adaptive indicators of the model are further analyzed as shown in Table 2.

Table 2. Data structure of correlation analysis modeling between students’ web-based learning behavior and learning effect

Fitting indicator	Recommended value	Degree of fitting	Measured value	Adaptive judgment
<i>Absolute adaptive indicator</i>				
χ^2	P>0.05	Good model adaptability	0.185	Yes
GFI(goodness of fit index)	GFI<0.9	Good model adaptability	0.952	Yes
RMR (root mean square residual)	RMR<0.05	Good model adaptability	0.041	Yes
RMSEA(root mean square of Approximation)	RMSEA<0.1	Good model adaptability	0.026	Yes
<i>Appreciation adaptive indicator</i>				
AGFI(adjust goodness of fit index)	AGFI>0.9	Good model adaptability	0.931	Yes
NFI(normal of fit index)	NFI>0.9	Good model adaptability	0.915	Yes
CFI (compare fit index)	CFI>0.9	Good model adaptability	0.98	Yes
IFI (incremental fit index)	IFI>0.9	Good model adaptability	0.989	Yes
<i>Simple fitness index</i>				
NFI (Normal fit index)	CFI>0.9	Good model adaptability	1.197	Yes
PNFI (Parismony adjusted NFI)	PNFI>0.05	Good model adaptability	0.742	Yes
PCFI (Parismony adjusted CFI)	PCFI>0.05	Good model adaptability	0.775	Yes

The path analysis result and hypothesis verification result gained according to the above adaptive indicators are shown in Table 3:

Table 3. Path analysis result and hypothesis verification result

Hypothesis	Route	Path coefficient (β)	P	Verification
H1	SE---U1	22	428	No support it
H2	SE---KS	37	***	Support it
H3	SE---EP	30	**	Support it
H4	EP---U1	15	223	No support it
H5	EP---KS	21	***	Support it
H6	T---U1	22	162	No support it
H7	T---KS	39	**	Support it
H8	T---EP	60	***	Support it
H9	S1---U1	11	224	No support it
H10	S1---KS	20	*	Support it
H11		09	271	No support it
H11	U1---KS	01	876	No support it

The ecological learning space teaching model based on inquiry learning is as below:

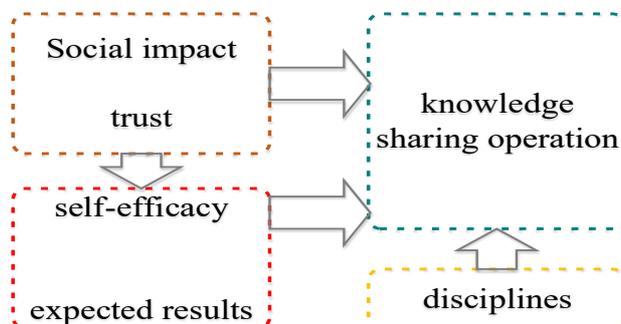


Fig. 5. Ecological learning space teaching model based on inquiry learning

4 Teaching Example and Effect

4.1 Teaching example

College basketball course was chosen in this study to verify the effect of network digital teaching mode based on ecological learning space. The object of study is an experimental class (48 students in total). To study the effect of teaching mode reform, the control class (50 students) in the same grade was given the conventional classroom PPT teaching. The course was taught once per week, 2 class hours every time.

Under the guidance of mode frame system established above and the precondition of ensuring the interaction process among the teacher, students and learning contents, the teaching design of college basketball course which combines the learning content is shown in Fig.6.

Theoretical knowledge system study: According to the detailed content of theoretical knowledge of basketball, the teacher guided students to know the real situation of students by network resources and mobile classroom. The students formed teams to answer questions. In class, students were grouped to solve problems. The teacher gave guidance, evaluation and feedback in students' autonomous learning process. After class, basketball competition, rehearsal and other practical activities extended to enhance students' interactions. Finally, the teacher summarized.

Practical athletic ability training: For the detailed basketball skill learning, the teacher should first clearly know the application situations of specific skills. Aiming at relevant problems of basketball, the teacher designed relevant contents for groups to discuss and find out the solutions. After class, the teacher required students to practice and apply the key skills to consolidate them.

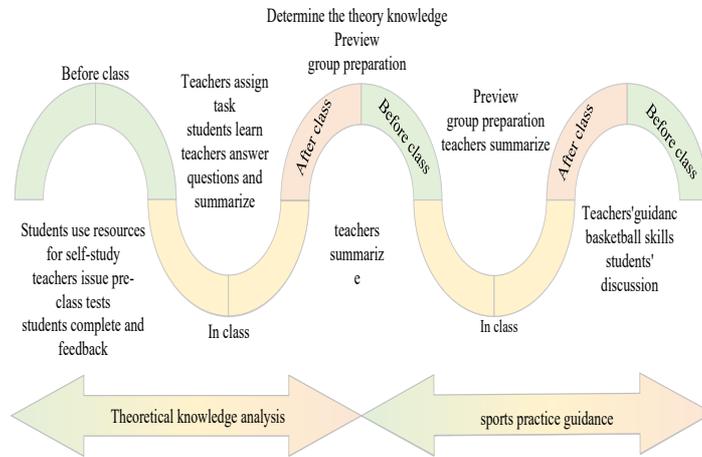


Fig. 6. College basketball learning process based on ecological learning space



Fig. 7. Courseware screenshot I of college basketball based on ecological learning space

Figs.6-9 exhibit the applications of college basketball courseware based on ecological learning space. In Fig.7, ecological learning space is utilized to show the offence and defense skills of the course in the form of animation. In Fig.8, both the teacher and students can draw on the iPad with fingers. They can utilize the preset scene, map out the players' positions, sketch positions of both parties and passing path, modify, save, record, and play the above contents. In Fig.9, students simulate the competition in the ecological space. The player can be move to any place on the screen, and the passing path can be drawn. Meanwhile, the halftime competition and the whole competition can be preset under the teacher's guidance.



Fig. 8. Courseware screenshot II of college basketball based on ecological learning space



Fig. 9. Courseware screenshot III of college basketball based on ecological learning space

4.2 Teaching effect

The questionnaire survey and interview were combined to survey actual feelings of experimental class and reference class. The questionnaire contained 7 test questions to investigate students' feedback to the teaching mode, and it was scored by 5-point scoring method of Likert scale.

In accordance with the investigation statistics of experimental class, the acceptance aspects and degree of recognition for the teaching mode are shown. It can be seen that, the mode is approved by the experimental class, while the degree of recognition of control class for evaluation items is not high. For the students in the experimental class, the difficulty of teaching contents under such mode is suitable, and the contents are all-round, with much practical knowledge. Besides, the guidance function for

students is obvious, and the mode also can promote other subjects. In the task completion process, students take delight in participation, and their physical quality also improves synchronously. The findings indicate that under such mode, students independently study and interact so that their learning interest improves a lot, and learning initiative is enhanced, which greatly facilitates students to develop the habit of lifelong physical exercise and improves their physical quality. Furthermore, the combination of inquiry learning, network resources and teaching platform resources greatly broaden students' view. In addition, with teacher's effective guidance and standardization of teaching management platform, students can be guided to learn efficiently and actively, further enhance learning ability, strengthen physical quality and develop the habit of lifelong exercise.

Based on the further analysis of teaching reform of the course, the teacher should effectively guide, organize, manage and supervise students in the interactive learning process. Thus, higher requirements are proposed for teacher's professional quality and theoretical level. Only when the teacher strictly controls effective operation of the mode can more effective teaching effect be gained.

5 Conclusion

In this study, college basketball course was taken for example to establish the ecological learning space teaching mode based on inquiry learning. A control class for which traditional PPT teaching was used was selected to survey the teaching effect. The conclusions are as below:

- Through constructing ecological learning space teaching platform, the mode fully utilizes network teaching resources to enrich the teaching content. On the basis of basketball practice, the interaction, guidance and exchange among the teacher, students and teaching contents are enhanced, and students' efficient learning and active learning are effectively guided. As well, students' learning ability is cultivated.
- The mode can promote students' learning interest and learning self-regulation, make them cultivate the pursuit of lifelong quality promotion and reach the teaching objective of PE course.
- The teaching reform of the course proposes higher requirements for teacher's guidance, organization, management and supervision abilities. Only when the teacher strictly controls the effective operation of the mode can more effective teaching effect can be obtained.

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